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PERFORMANCE CHARACTERISTICS OF AUTOMOTIVE ENGINES IN THE UNITED STATES

First Series - Report No. 17

1975 Buick 455 CID (7.5 Liters), 4V

T. W. Chamberlain
D. E. Koehler
K. R. Stamper
W. F. Marshall

U.S. DEPARTMENT OF ENERGY
BARTLESVILLE ENERGY RESEARCH CENTER
P.O. Box 1398
Bartlesville OK 74003

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Washington DC 20590

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T. W. Chamberlain, D. E. Koehler
K. R. Stamper, and W. F. Marshall

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16. Abstract

Experimental data were obtained in dynamometer tests of a 1975 Buick 455 CID, 4V engine to determine fuel consumption and emissions (hydrocarbon, carbon monoxide, oxides of nitrogen) at steady-state engine-operating modes. The objective of the program is to obtain engine performance data for estimating emissions and fuel economy for varied engine service and duty. The intent of the work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

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PREFACE

This report, prepared by the U.S. Department of Energy, Bartlesville Energy Research Center, for the U.S. Department of Transportation, Transportation Systems Center, Energy Technology Branch, Cambridge MA, presents results of experimental work to obtain information on performance characteristics of an engine used in automobiles sold in the United States. The engine used in this work is one of a series of 23 engines to be tested in the current program.

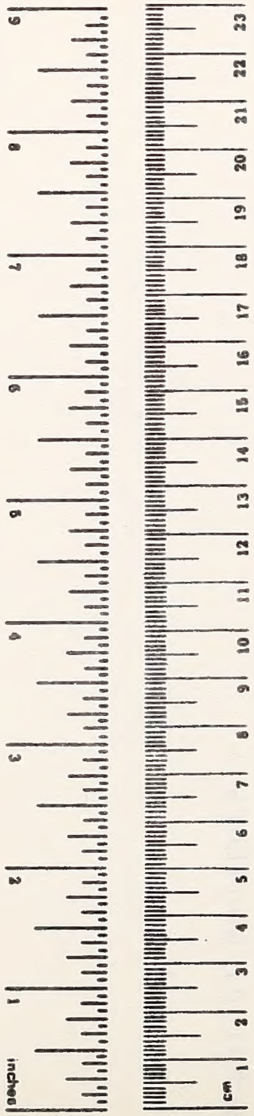
This project is funded by the National Highway Traffic Safety Administration, Office of Research and Development, Office of Passenger Vehicle Research, Technology Assessment Division.

Ralph G. Colello and James A. Kidd, Jr., of the U.S. Department of Transportation, Transportation Systems Center, are the technical monitors.

METRIC CONVERSION FACTORS

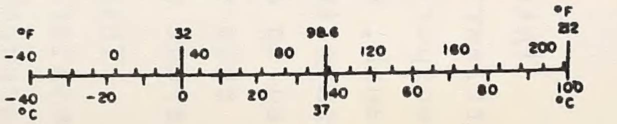
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



1. INTRODUCTION

The data acquired from tests of a 1975 Buick 455 CID, 4V engine are presented in this report. This engine is used by Buick in full-size vehicles (Riviera, Electra 225, Electra Limited, and Estate Wagon). The test results are sufficient to establish steady-state maps for fuel consumption and emission rates (carbon monoxide, unburned hydrocarbon, and oxides of nitrogen) over the entire operating range of the engine.

The objective of this program is to obtain engine performance data for estimating emissions and fuel economy for varied engine, service, and duty. The intent of this work is to provide basic engine characteristic data required as input for engineering calculations involving ground transportation.

2. ENGINE TEST REPORT

General engine specifications for the Buick 455 CID, 4V engine are given in table 1. The engine break-in (table 2) and tests were run using a single batch of unleaded regular grade gasoline; a fuel analysis is given in table 3.

The engine break-in and tests were conducted with a new mean-tolerance engine mounted on a test stand and coupled to an eddy-current dynamometer. The engine was complete except for the fan and a cooling tower was used in place of radiator. The engine was equipped with an alternator, but it was not wired into the engine's electrical system. The operative emission control systems included an oxidation catalyst, exhaust-gas-recirculation (EGR), early fuel evaporation, and high energy ignition.

The engine was operated at various speeds and loads designed to approximate road-load conditions over a 42-hour period for break-in. The engine test began on 5 and ended on 19 May 1976 giving a total engine operating time of approximately 110 hours. The engine was tested while operating at the steady-state modes shown in table 4.

The following data were recorded for each test point:

Test number
Date
Barometric pressure, mm Hg
Dewpoint, °F
Inlet air temperature, °F
Speed, rpm
Torque, lb-ft -- BLH strain gage load cell; Daytronics indicator
Fuel rate, lb/hr -- Fluidyne positive displacement fuel flowmeter
Ignition timing, °BTC
Manifold vacuum, in. Hg
Throttle angle, deg
CO, pct -- Beckman NDIR
CO_2, pct -- Beckman NDIR
O_2, pct -- Beckman polarographic detector
HC, ppmC -- Custom-built heated flame ionization detector
NO_x, ppm -- Thermo-Electron chemiluminescent detector
Oil temperature, °F
Oil pressure, psig
Coolant temperature, °F
Exhaust temperature, °F
Exhaust pressure, in. H_2O
Intake manifold temperature, °F .

The following equations were used in calculating power, air/fuel ratio, absolute humidity, and mass emission rates of carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NO_x):

1. Partial pressure of water vapor in intake air (millimeters of mercury):

$$P = \exp\left[18.717 - \frac{7308.1}{393 + D}\right],$$

where D = Dewpoint, °F.

2. Absolute humidity (grains moisture per pound dry air):

$$H = \frac{4347.8(P)}{B - P},$$

where B = barometric pressure, mm Hg.

3. Humidity correction factor (dimensionless):

$$K_H = \frac{1}{1 - 0.0047(H - 75)}.$$

Note: This factor is used to correct the NO_x mass emission rate to a standard humidity of 75 grains moisture per pound dry air.

4. Stoichiometric air/fuel ratio (dimensionless):

$$AF_s = \frac{69(2 + \frac{x}{2} - y)}{MW_{fuel}},$$

where x = hydrogen-carbon atomic ratio of fuel,
y = oxygen-carbon atomic ratio of fuel,
MW_{fuel} = fuel molecular weight per carbon atom,
= $12.01115 + 1.00797x + 15.9994y$.

5. Hydrogen concentration in raw exhaust (percent):

$$H_2 = \frac{x(CO)(CO + CO_2)}{2(CO + 3CO_2)},$$

where CO = carbon-monoxide concentration (percent),
CO_2 = carbon-dioxide concentration (percent).

Note: This equation assumes a water-gas shift equilibrium constant

$$\frac{(CO)(H_2O)}{(CO_2)(H_2)} = 3.$$

6. Correction factor for emission concentrations from wet basis to dry basis (dimensionless):

$$C_w = 1 + \frac{(\frac{x}{2})(CO + CO_2) - H_2}{100} .$$

Note: In these tests only HC is measured on a wet basis. All other species are measured on a dry basis.

7. Air/fuel ratio (dimensionless):

$$AF = \frac{AF_s}{2 + \frac{x}{2} - y}\left[\frac{(1+ \frac{x}{2} - y)(CO) + (2 + \frac{x}{2} - y)(CO_2) + 2(O_2) + \frac{NO_x}{10^4} - H_2}{CO + CO_2 + C_w(\frac{HC}{10^4})}\right],$$

where O_2 = oxygen concentration (percent),
NO_x = oxides of nitrogen (ppm),
HC = unburned hydrocarbon concentration (ppmC).

8. Exhaust flow (pounds per hour):

$$M_{EX} = M_F(1+AF),$$

where M_F = fuel flow rate (pounds per hour).

9. Carbon monoxide mass emission rate (grams per hour):

$$M_{CO} = \frac{M_{EX}}{C_w}\left(\frac{CO}{100}\right)\left(\frac{MW_{CO}}{MW_{EX}}\right)453.59237,$$

where MW_{CO} = molecular weight of CO (=28.01115),
MW_{EX} = molecular weight of exhaust gas (=28.967).

10. Unburned hydrocarbon mass emission rate (grams per hour):

$$M_{HC} = M_{EX}\left(\frac{HC}{10^6}\right)\left(\frac{MW_{HC}}{MW_{EX}}\right)453.59237,$$

where MW_{HC} = molecular weight per carbon atom of HC,
= 12.01115 + 1.00797x + 15.9994y.

11. Oxides of nitrogen mass emission rate (grams per hour):

$$M_{NO_x} = \frac{M_{EX}}{C_w}\left(\frac{NO_x}{10^6}\right)\left(\frac{MW_{NO_x}}{MW_{EX}}\right)(K_H)453.59237,$$

where MW_{NO_x} = molecular weight of NO_2 (=46.0028).

12. Power (brake horsepower corrected to a standard barometric pressure of 736.6 mm Hg and a standard temperature of 85° F):

$$HP = \frac{N(T)}{5252.113}\left(\frac{736.6}{B - P}\right)\sqrt{\frac{t + 460}{545}},$$

where N = engine speed (revolutions per minute),
T = brake torque (foot-pounds),
t = air temperature (°F).

3. DISCUSSION OF TEST RESULTS

Engine performance at wide-open-throttle (WOT) showed that the peak torque and brake horsepower output produced by the test engine were slightly lower than the figures quoted in table 1. Figure 1 indicates that minimum brake specific fuel consumption (bsfc) at WOT occurred at approximately the same engine speed as maximum torque. Air-fuel ratio was maintained slightly lean except for high speed (above 2,500 rpm) or high load (above 60 pct of full load) conditions (figure 2). Emissions of carbon monoxide and hydrocarbon were maintained at low levels except near WOT (figures 3 and 4). Maximum levels of NO_x emissions occurred typically at 60 to 100 pct of full load for each engine speed (figure 5). Fuel consumption rate data show good repeatability at most speed/load conditions (figure 6).

The test results presented are sufficient to establish steady-state maps of fuel consumption and emissions for this engine.

4. CONCLUSIONS

The purpose of the experimental work that is reported here is to establish data for this engine. Those data are presented in the accompanying tables of this report.

TABLE 1. MANUFACTURER'S ENGINE SPECIFICATIONS

Displacement, cu. in.	455
Maximum horsepower, bhp @ 3,800 rpm	205
Maximum torque, lb-ft @ 2,000 rpm	345
Bore and stroke, in.	4.312 X 3.900
Configuration	V-8
Compression ratio	8.0:1
Firing order	1-8-4-3-6-5-7-2
Ignition timing at idle speed, °BTDC @ 600 rpm	12
Block material	cast iron
Head material	cast iron
Number of crankshaft main bearings	5
Number of compression rings/piston	2
Number of oil rings/piston	1
Cam drive type	chain and sprocket
Spark plug gap, in.	0.060
Engine weight, lb	700
Exhaust-gas-recirculation system:	
Valve type	modulated
Control signal	ported vacuum
Point of discharge	intake manifold
Crankcase emission control:	
Control method	positive crankcase ventilation
Point of discharge	intake manifold
Carburetor type	4V downdraft
Distributor specifications:	
Centrifugal advance, begins ° @ 750-1,350 rpm	0
Centrifugal advance, intermediate, ° @ 3,000 rpm	9-12
Centrifugal advance, full, ° @ 4,400 rpm	14-18
Vacuum advance, begins, ° @ 4-6 in. Hg	0
Vacuum advance, maximum, ° @ 11 in. Hg	14-20
EGR valve number	WS7043438
Distributor number	H12894

TABLE 2. ENGINE BREAK-IN SCHEDULE

Simulated Vehicle Speed, mph	Engine Speed, rpm	Intake Manifold Vacuum, in. Hg	Fraction of Time in Mode
0	750	18.0	1/5
20	860	16.5	1/10
30	950	15.75	1/10
40	1,750	14.35	1/10
50	2,000	15.2	1/10
25	770	15.0	1/10
35	1,425	13.25	1/10
45	1,875	15.25	1/10
55	2,200	15.1	1/10

Total mileage per cycle = 75 miles.
Total mileage accumulated over 42-hour break-in period = 1,260 miles.

TABLE 3. FUEL SPECIFICATIONS

Fuel No	7602
Research octane No	91.5
Motor octane No	83.8
Reid vapor pressure, psig	11.9
Distillation, °F:	
10 pct	134
50 pct	214
95 pct	388
100 pct	418
Specific gravity	0.7128
API gravity, deg	67.0
FIA analysis, pct:	
Aromatics	11
Olefins	16
Paraffins	73
Sulfur, pct	0.024
Lead, g/gal	Trace
Hydrogen/carbon atomic ratio	2.090
Oxygen/carbon atomic ratio	0.000

TABLE 4. TEST-NUMBER CROSS-REFERENCE INDEX

Pct Full Load	Engine Speed, rpm									
	600	700	800	1,500	2,000	2,500	3,000	3,500	3,800	4,000
0	1 66 108	4 69	7 17 76	25 81	33 86	41 91	49 96	57 101	65	
10			8 16	24	32	40	48	56	64	
25		112	9 15 75	23 80	31 85	39 90	47 95	100	63 105	
40	2 67 109	5 70	14 74	22 79	30 84	38 89	46 94	54 99	62 104	
60			13 73	21 78	29 83	37 88	45 93	53 98	61 103	
75		71	12	20 140	28	36	44	52	60 146	
90	68		11 72	19 77	27 82	35 87	43 92	51 97	59 102	
100	3	6	10	18	26	34	42	50	58	107

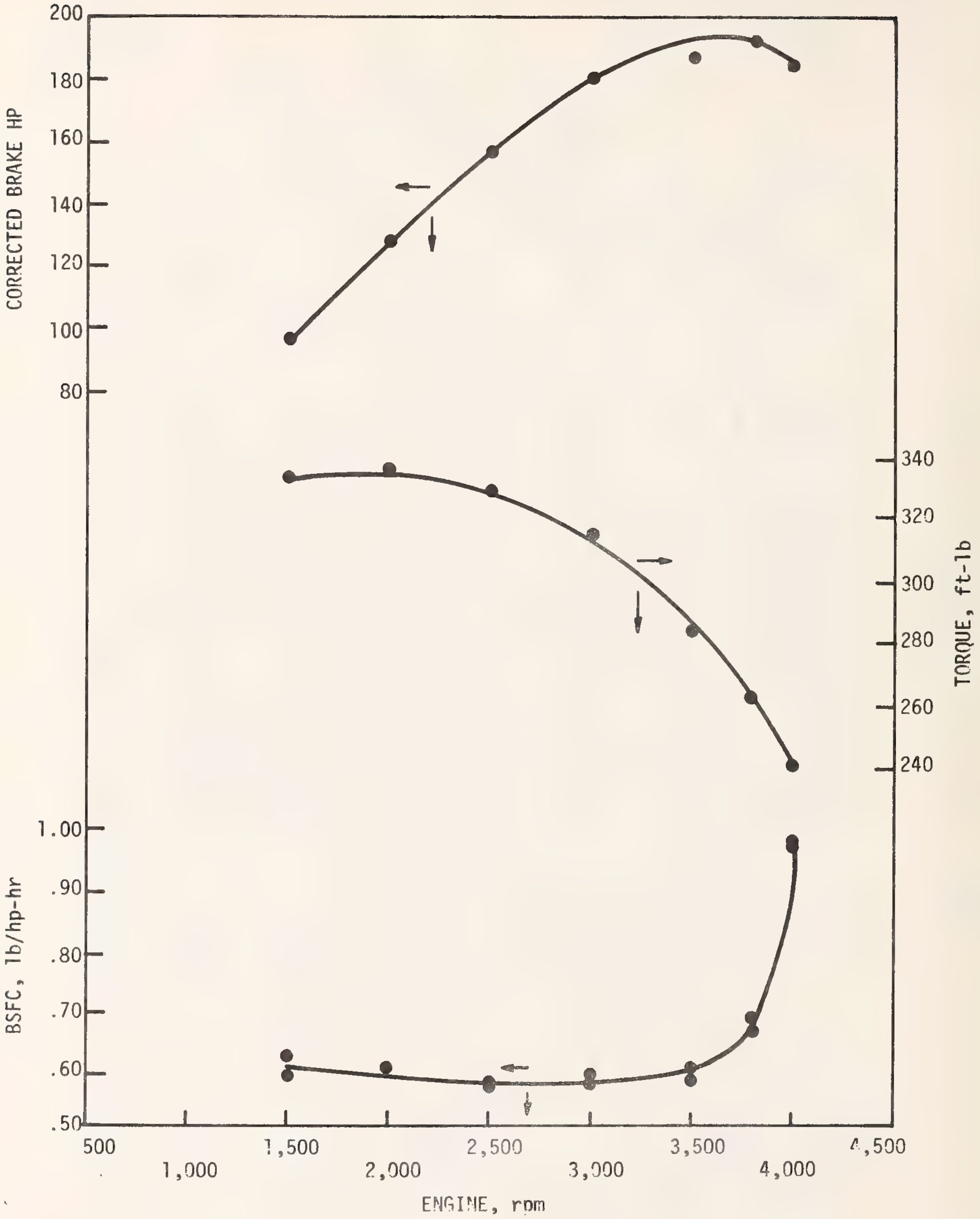


FIGURE 1. Brake Specific Fuel Consumption, Torque, and Brake Horsepower versus Engine rpm at Wide-Open-Throttle--455-CID Buick Engine.

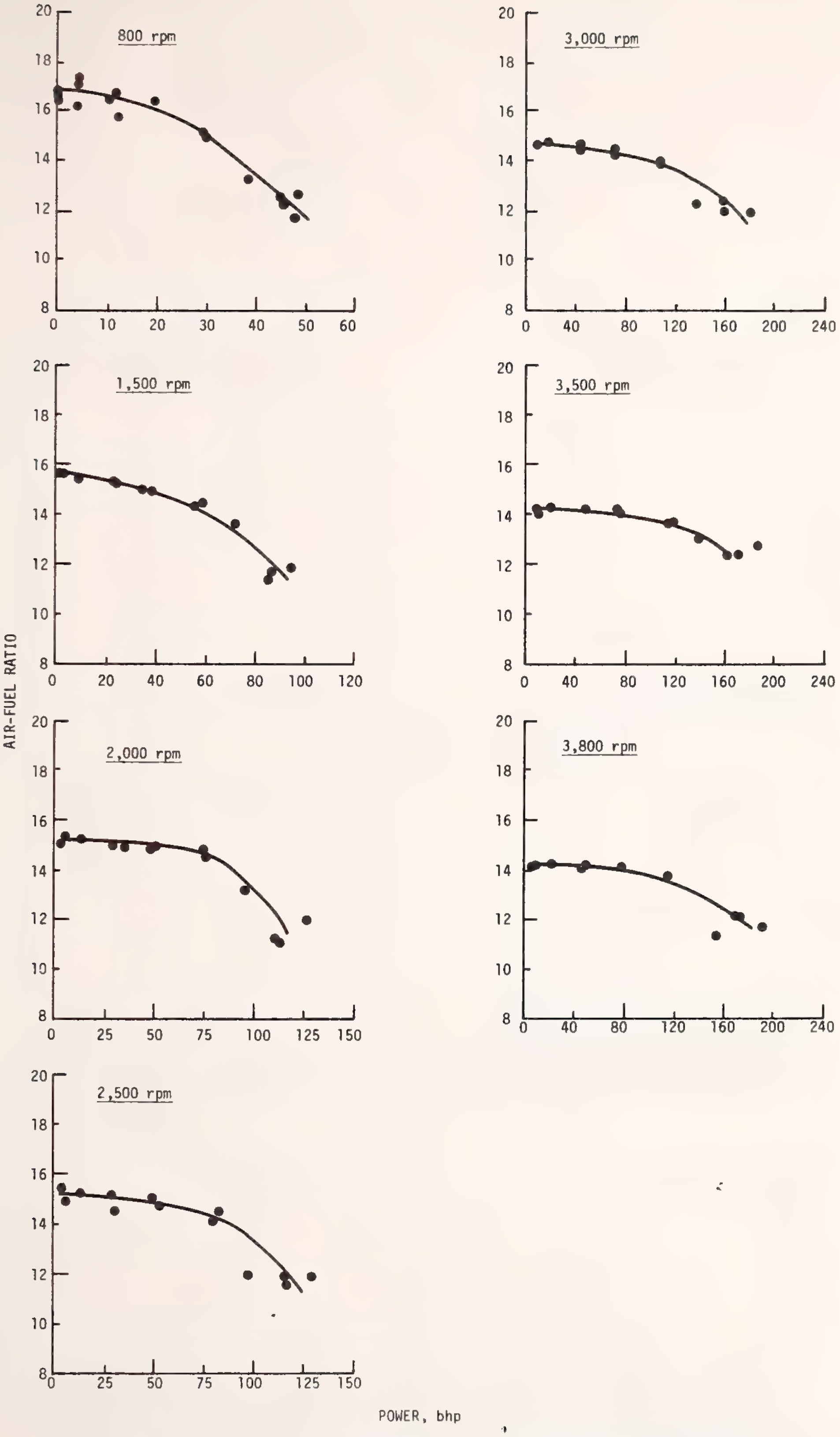


FIGURE 2. Air/Fuel Ratio versus Power at Various Speed and Load Conditions--455-CID Buick Engine.

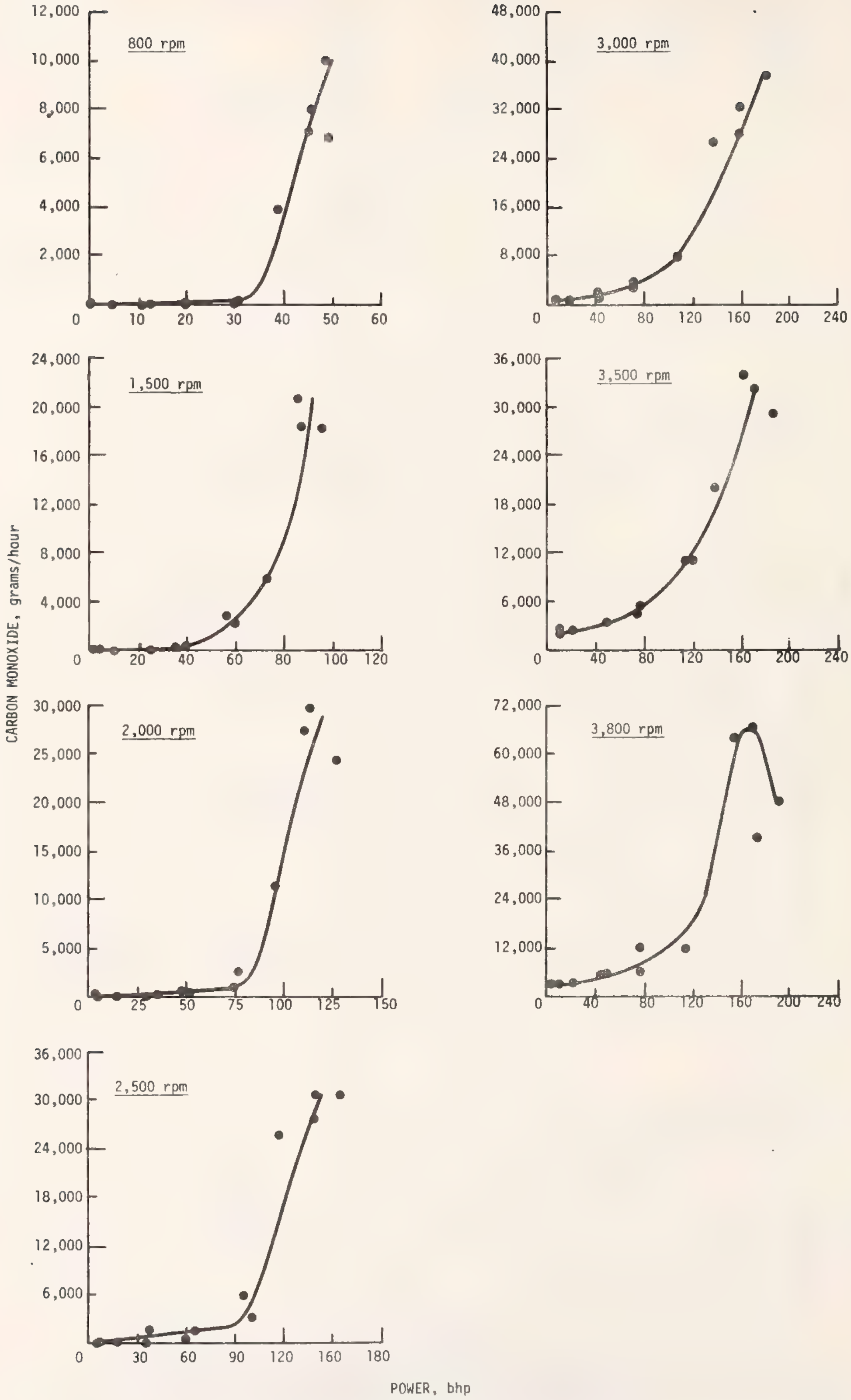


FIGURE 3. Carbon Monoxide Emissions versus Power at Various Speed and Load Conditions--455-CID Buick Engine.

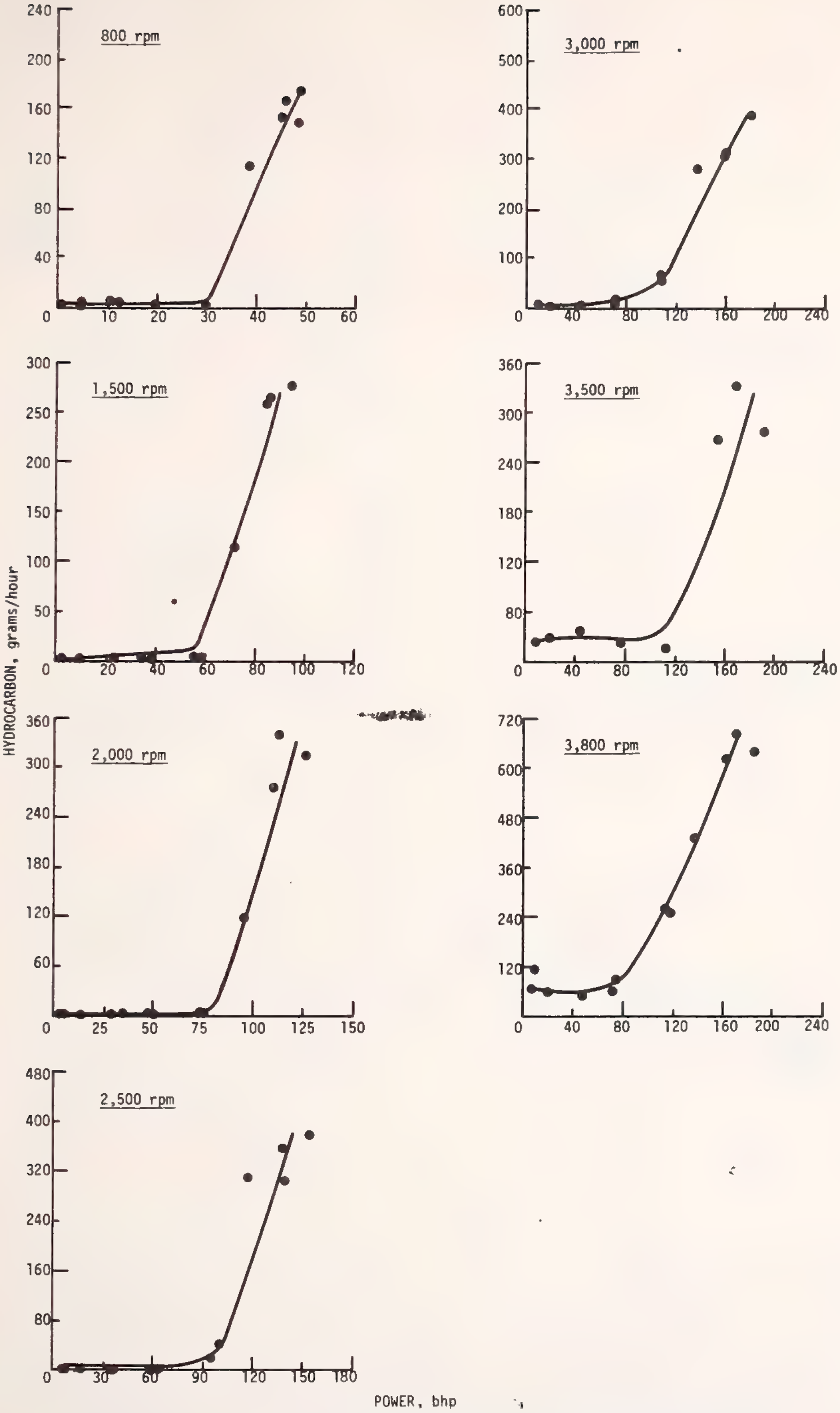


FIGURE 4. Hydrocarbon Emissions versus Power at Various Speed and Load Conditions--455-CID Buick Engine.

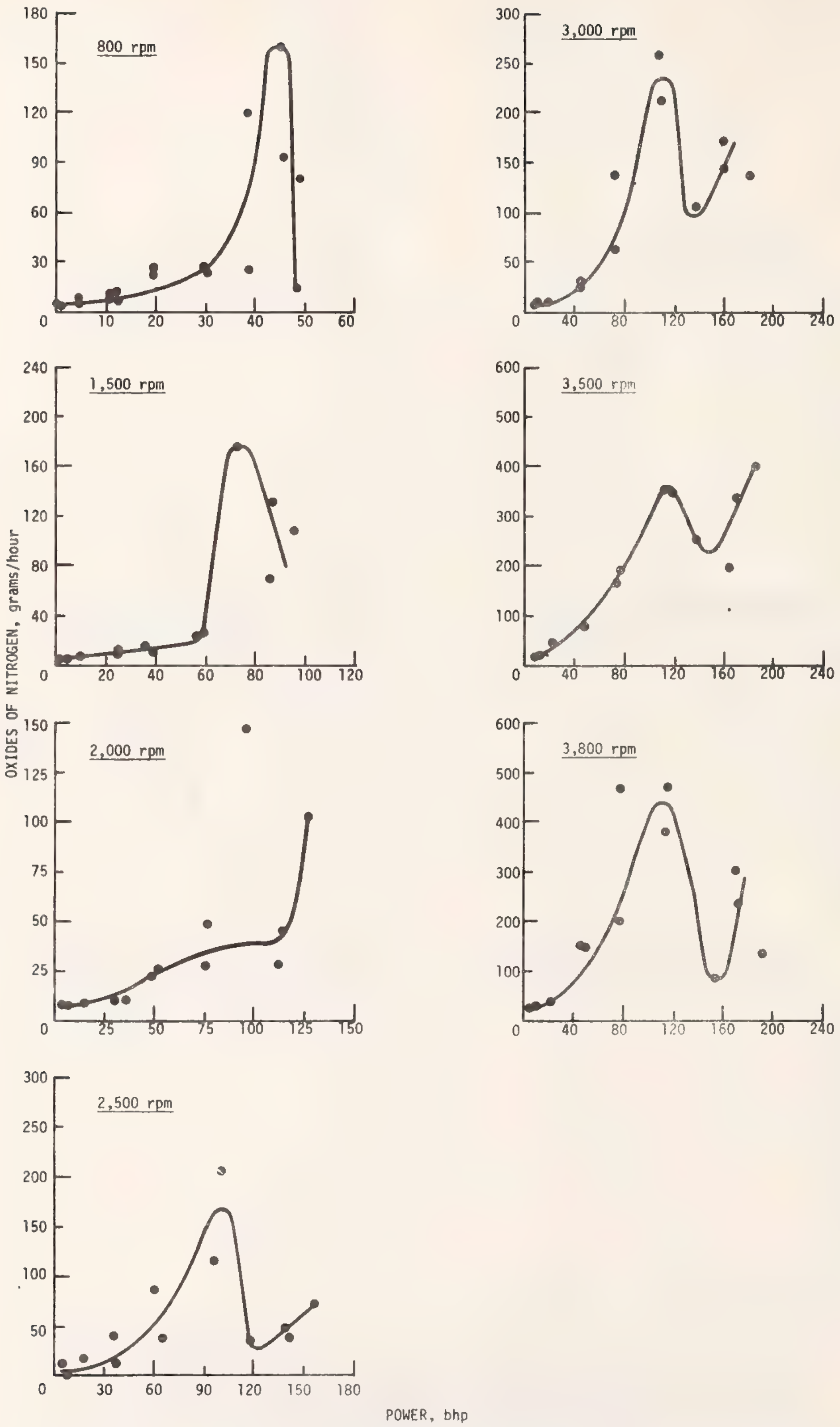


FIGURE 5. Oxides of Nitrogen Emissions versus Power at Various Speed and Load Conditions--455-CID Buick Engine.

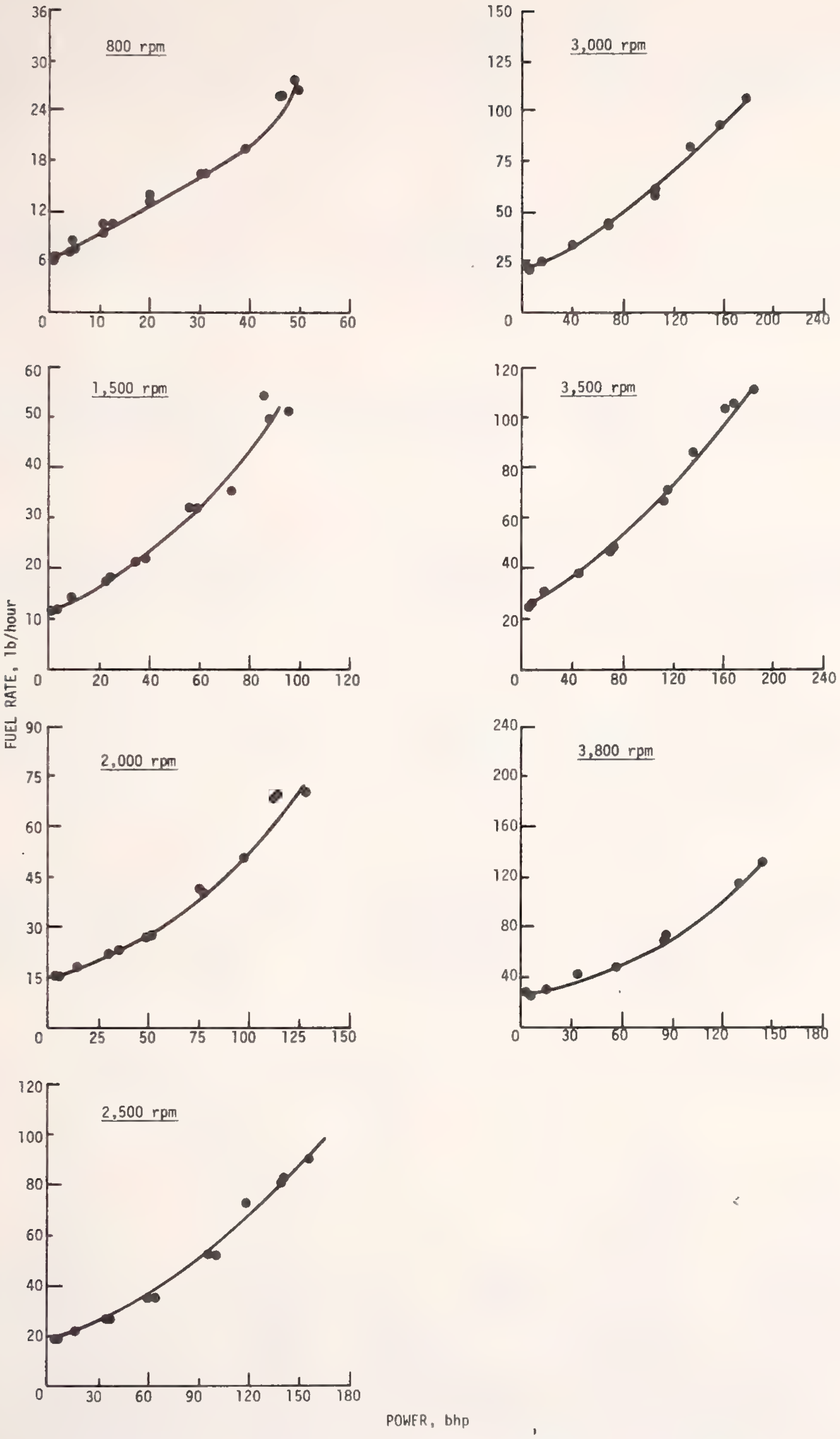


FIGURE 6. Fuel Rate versus Power at Various Speed and Load Conditions--455-CID Buick Engine.

ENGINE CODE BUI455

TEST NUMBER	1.1	1.2	2.1	2.2	3.1	3.2
TEST DATE	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.8	737.8	737.8	737.8	737.8	737.8
HUMIDITY, GRAINS/LB	59	59	59	59	59	59
TEMPERATURE, F	82	82	82	82	82	82
ENGINE SPEED, RPM	600	600	600	600	600	600
TORQUE, FT-LB	2.0	2.0	30.0	30.0	77.0	77.0
POWER, BHP*	.2	.2	3.5	3.5	8.9	8.9
FUEL RATE, LB/HR	4.4	4.4	5.3	5.3	6.9	6.9
IGNITION TIMING, DEG BTDC	12.0	12.0	11.5	11.5	11.2	11.2
MANIFOLD VACUUM, IN HG	18.2	18.2	16.4	16.4	13.5	13.5
THROTTLE ANGLE, DEG	.0	.0	2.0	2.0	5.0	5.0
INTAKE MAN. TEMP., F	138	138	135	135	132	132
CONCENTRATIONS, DRY BASIS						
CO, %	.3390	.0024	.3390	.0024	.1084	.0024
CO2, %	12.25	14.35	13.27	13.67	13.14	13.48
O2, %	3.55	1.10	2.25	1.93	2.55	2.30
HC, PPMC	15826	190	1883	126	1736	99
NOX, PPM	43	66	92	88	330	265
AIR/FUEL RATIO	15.51	15.61	16.11	16.25	16.51	16.55
EMISSION RATES, G/HR						
CO	95.8	.7	117.8	.9	50.8	1.1
HC	225.5	2.7	33.0	2.2	41.0	2.3
NOX+	1.9	2.8	4.9	4.7	23.7	19.0
OIL TEMPERATURE, F	188	188	189	189	191	191
OIL PRESSURE, PSI	19	19	18	18	18	18
COOLANT TEMPERATURE, F	177	177	173	173	176	176
EXHAUST PRESSURE, IN. H2O	3.0	1.0	4.0	1.0	4.0	1.0
EXHAUST TEMPERATURE, F	740	752	735	740	649	657

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	4.1	4.2	5.1	5.2	6.1	6.2
TEST DATE	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.8	737.8	737.8	737.8	737.8	737.8
HUMIDITY, GRAINS/LB	59	59	59	59	59	59
TEMPERATURE, F	82	82	87	87	83	83
ENGINE SPEED, RPM	700	700	700	700	700	700
TORQUE, FT-LB	1.0	1.0	19.0	19.0	69.0	69.0
POWER, BHP*	.1	.1	2.6	2.6	9.3	9.3
FUEL RATE, LB/HR	5.0	5.0	5.8	5.8	7.6	7.6
IGNITION TIMING, DEG BTDC	10.5	10.5	10.5	10.5	13.0	13.0
MANIFOLD VACUUM, IN HG	18.0	18.0	17.2	17.2	14.0	14.0
THROTTLE ANGLE, DEG	1.8	1.8	3.0	3.0	6.0	6.0
INTAKE MAN. TEMP., F	137	137	137	137	136	136
CONCENTRATIONS, DRY BASIS						
CO, %	.2686	.0024	.2354	.0024	.0988	.0024
CO2, %	12.02	13.80	13.27	13.66	13.00	13.22
O2, %	3.97	1.90	2.45	2.10	2.95	2.75
HC, PPMC	14093	126	1368	91	1364	77
NOX, PPM	53	66	83	87	320	275
AIR/FUEL RATIO	16.06	16.21	16.38	16.38	16.87	16.91
EMISSION RATES, G/HR						
CO	88.7	.8	92.0	.9	51.5	1.3
HC	234.5	2.1	26.9	1.8	35.8	2.0
NOX+	2.7	3.3	5.0	5.2	25.5	22.0
OIL TEMPERATURE, F	194	192	194	194	194	194
OIL PRESSURE, PSI	19	19	20	20	20	20
COOLANT TEMPERATURE, F	177	177	168	168	173	173
EXHAUST PRESSURE, IN. H2O	5.0	1.0	4.0	1.0	4.0	1.0
EXHAUST TEMPERATURE, F	720	730	661	665	682	681

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	7.1	7.2	8.1	8.2	9.1	9.2
TEST DATE	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76	5/ 5/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.8	737.8	737.8	737.8	737.8	737.8
HUMIDITY, GRAINS/LB	59	59	59	59	59	59
TEMPERATURE, F	83	83	83	83	82	82
ENGINE SPEED, RPM	800	800	800	800	800	800
TORQUE, FT-LB	2.0	2.0	28.0	28.0	69.0	69.0
POWER, BHP*	.3	.3	4.3	4.3	10.6	10.6
FUEL RATE, LB/HR	6.1	6.1	7.1	7.1	9.2	9.2
IGNITION TIMING, DEG BTDC	11.5	11.5	11.5	11.5	26.0	26.0
MANIFOLD VACUUM, IN HG	18.2	18.2	17.0	17.0	10.5	10.5
THROTTLE ANGLE, DEG	3.5	3.5	5.0	5.0	8.5	8.5
INTAKE MAN. TEMP., F	140	140	145	145	160	160
CONCENTRATIONS, DRY BASIS						
CO, %	.2278	.0018	.2635	.0024	.2635	.0024
CO2, %	13.00	13.66	12.87	13.66	12.87	13.66
O2, %	2.75	2.17	2.15	1.95	2.75	2.25
HC, PPMC	3412	114	1034	79	5682	177
NOX, PPM	67	84	125	120	105	113
AIR/FUEL RATIO	16.38	16.42	16.23	16.27	16.10	16.47
EMISSION RATES, G/HR						
CO	92.7	.7	124.8	1.1	160.6	1.5
HC	70.0	2.3	24.7	1.9	174.5	5.5
NOX+	4.2	5.2	9.1	8.7	9.8	10.7
OIL TEMPERATURE, F	195	195	197	197	198	198
OIL PRESSURE, PSI	24	24	24	24	22	22
COOLANT TEMPERATURE, F	172	172	172	172	174	174
EXHAUST PRESSURE, IN. H2O	4.0	1.0	4.0	1.0	5.0	1.0
EXHAUST TEMPERATURE, F	670	671	733	730	800	793

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	10.1	10.2	11.1	11.2	12.1	12.2
TEST DATE	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.1	745.1	745.1	745.1	745.1	745.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	80	80	81	80	81	81
ENGINE SPEED, RPM	800	800	800	800	800	800
TORQUE, FT-LB	323.0	323.0	297.0	301.0	257.0	254.0
POWER, BHP*	49.0	49.0	45.1	45.7	39.1	38.6
FUEL RATE, LB/HR	26.3	26.4	26.5	25.8	19.2	19.3
IGNITION TIMING, DEG BTDC	12.0	12.0	12.0	12.0	12.0	12.0
MANIFOLD VACUUM, IN HG	.0	.0	1.2	1.2	2.2	2.2
THROTTLE ANGLE, DEG	70.0	70.0	30.0	30.0	21.0	20.1
INTAKE MAN. TEMP., F	153	153	147	147	162	162
CONCENTRATIONS, DRY BASIS						
CO, %	4.7840	5.0000	6.1300	6.1800	3.7719	3.7300
CO2, %	11.55	11.44	10.50	10.90	12.20	12.38
O2, %	.15	.13	.15	.13	.17	.15
HC, PPMC	2731	2501	2835	2530	2389	2133
NOX, PPM	500	380	430	470	770	750
AIR/FUEL RATIO	12.72	12.64	12.14	12.21	13.18	13.22
EMISSION RATES, G/HR						
CO	6597.1	6860.4	8163.4	8029.4	3913.6	3904.0
HC	189.8	173.0	190.3	165.7	124.9	112.5
NOX+	104.4	79.0	86.7	92.5	121.0	118.9
OIL TEMPERATURE, F	205	205	213	215	214	214
OIL PRESSURE, PSI	18	18	18	18	18	18
COOLANT TEMPERATURE, F	175	175	171	170	175	175
EXHAUST PRESSURE, IN. H2O	14.0	5.0	13.0	4.0	10.0	2.0
EXHAUST TEMPERATURE, F	825	830	812	808	797	852

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	13.1	13.2	14.1	14.2	15.1	15.2
TEST DATE	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.1	745.1	745.1	745.1	745.1	745.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	81	81	81	81	82	82
ENGINE SPEED, RPM	800	800	800	800	800	800
TORQUE, FT-LB	195.0	195.0	127.0	128.0	80.5	79.0
POWER, BHP*	29.6	29.6	19.3	19.5	12.2	12.0
FUEL RATE, LB/HR	16.2	16.5	13.7	13.8	10.0	10.0
IGNITION TIMING, DEG BTDC	11.5	11.5	12.0	12.0	24.0	24.0
MANIFOLD VACUUM, IN HG	3.6	3.6	4.5	4.5	9.0	9.0
THROTTLE ANGLE, DEG	16.9	16.9	14.0	12.3	7.5	7.5
INTAKE MAN. TEMP., F	184	184	203	203	213	213
CONCENTRATIONS, DRY BASIS						
CO, %	1.2100	.0940	.5250	.1180	.3090	.0012
CO2, %	12.75	14.63	12.75	13.27	11.55	13.01
O2, %	1.60	.43	2.85	2.25	4.25	2.60
HC, PPMC	1455	32	3183	85	13474	119
NOX, PPM	250	175	205	188	83	111
AIR/FUEL RATIO	15.27	15.13	16.33	16.46	16.36	16.82
EMISSION RATES, G/HR						
CO	1223.1	94.9	480.6	109.5	208.8	.8
HC	74.1	1.6	146.9	4.0	458.8	4.2
NOX+	38.3	26.7	28.4	26.3	8.4	11.6
OIL TEMPERATURE, F	210	210	208	208	204	204
OIL PRESSURE, PSI	20	20	22	22	22	22
COOLANT TEMPERATURE, F	160	160	176	176	171	171
EXHAUST PRESSURE, IN. H2O	11.0	3.0	10.0	3.0	8.0	2.0
EXHAUST TEMPERATURE, F	826	1044	843	984	703	1000

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	16.1	16.2	17.1	17.2	18.1	18.2
TEST DATE	5/10/76	5/10/76	5/10/76	5/10/76	5/ 6/76	5/ 6/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.1	745.1	745.1	745.1	737.8	737.8
HUMIDITY, GRAINS/LB	56	56	56	56	59	59
TEMPERATURE, F	81	81	81	81	82	82
ENGINE SPEED, RPM	800	800	800	800	1500	1500
TORQUE, FT-LB	32.0	31.0	5.0	5.0	332.0	332.0
POWER, BHP*	4.9	4.7	.8	.8	95.7	95.7
FUEL RATE, LB/HR	7.5	7.5	6.5	6.5	52.2	51.0
IGNITION TIMING, DEG BTDC	13.5	13.5	12.0	12.0	16.5	16.6
MANIFOLD VACUUM, IN HG	15.5	15.5	18.5	18.5	.3	.3
THROTTLE ANGLE, DEG	3.0	3.0	1.0	1.0	70.0	70.0
INTAKE MAN. TEMP., F	198	198	168	168	103	103
CONCENTRATIONS, DRY BASIS						
CO, %	.1420	.0012	.1826	.0024	7.1800	7.2400
CO2, %	12.13	12.62	11.78	13.01	10.50	10.50
O2, %	3.65	3.30	4.25	2.65	.10	.05
HC, PPMC	259	198	10681	199	2358	2186
NOX, PPM	75	54	35	56	370	280
AIR/FUEL RATIO	17.68	17.41	16.76	16.85	11.86	11.82
EMISSION RATES, G/HR						
CO	77.6	.7	81.9	1.1	18377.7	18046.1
HC	7.1	5.4	241.6	4.5	304.2	274.7
NOX+	6.2	4.4	2.4	3.8	144.9	106.8
OIL TEMPERATURE, F	200	200	198	198	230	230
OIL PRESSURE, PSI	24	24	25	25	38	38
COOLANT TEMPERATURE, F	170	170	174	174	173	173
EXHAUST PRESSURE, IN. H2O	5.0	1.0	4.0	1.0	50.0	18.0
EXHAUST TEMPERATURE, F	650	888	618	866	1086	1075

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	19.1	19.2	20.1	20.2	21.1	21.2
TEST DATE	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.8	737.8	737.8	737.8	745.0	745.0
HUMIDITY, GRAINS/LB	59	59	59	59	50	50
TEMPERATURE, F	83	83	85	85	79	79
ENGINE SPEED, RPM	1500	1500	1500	1500	1500	1500
TORQUE, FT-LB	303.0	303.0	252.0	252.0	198.0	198.0
POWER, BHP*	87.4	87.4	72.8	72.8	56.3	56.3
FUEL RATE, LB/HR	49.5	49.5	35.1	35.1	32.2	31.9
IGNITION TIMING, DEG BTDC	17.0	17.0	16.5	16.5	17.0	17.0
MANIFOLD VACUUM, IN HG	2.2	2.2	2.7	2.7	4.7	4.7
THROTTLE ANGLE, DEG	43.0	43.0	34.0	34.0	29.0	29.0
INTAKE MAN. TEMP., F	123	123	160	160	161	161
CONCENTRATIONS, DRY BASIS						
CO, %	7.2400	7.6500	3.0700	2.9600	2.6600	1.4700
CO2, %	10.30	10.30	12.98	13.05	12.62	14.21
O2, %	.10	.05	.18	.05	.92	.05
HC, PPMC	2354	2186	1675	1156	988	46
NOX, PPM	470	355	840	590	238	84
AIR/FUEL RATIO	11.81	11.68	13.57	13.57	14.20	14.28
EMISSION RATES, G/HR						
CO	17512.1	18293.3	5964.3	5751.2	4973.2	2717.0
HC	287.0	263.4	164.1	113.2	93.1	4.3
NOX+	174.0	129.9	249.8	175.4	65.6	22.9
OIL TEMPERATURE, F	240	240	240	240	213	213
OIL PRESSURE, PSI	35	35	35	35	43	43
COOLANT TEMPERATURE, F	171	171	172	172	171	171
EXHAUST PRESSURE, IN. H2O	44.0	14.0	32.0	10.0	30.0	9.0
EXHAUST TEMPERATURE, F	1080	1070	1097	1098	1069	1178

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	22.1	22.2	23.1	23.2	24.1	24.2
TEST DATE	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	50	50	50	50	50	50
TEMPERATURE, F	80	80	80	80	82	82
ENGINE SPEED, RPM	1500	1500	1500	1500	1500	1500
TORQUE, FT-LB	124.0	124.0	86.0	86.0	34.0	34.0
POWER, BHP*	35.3	35.3	24.5	24.5	9.7	9.7
FUEL RATE, LB/HR	21.0	21.0	18.2	18.2	14.0	14.0
IGNITION TIMING, DEG BTDC	30.5	30.5	34.0	34.0	34.0	34.0
MANIFOLD VACUUM, IN HG	10.0	10.0	12.5	12.5	15.1	15.1
THROTTLE ANGLE, DEG	18.5	18.5	16.0	16.0	11.5	11.5
INTAKE MAN. TEMP., F	217	217	229	229	240	240
CONCENTRATIONS, DRY BASIS						
CO, %	1.3300	.1465	1.4700	.0447	1.2600	.0049
CO2, %	13.53	15.06	12.88	14.92	12.38	14.78
O2, %	1.20	.25	1.75	.47	2.65	.75
HC, PPMC	1323	24	2518	28	8306	32
NOX, PPM	183	85	105	68	55	58
AIR/FUEL RATIO	14.94	14.98	15.12	15.17	15.24	15.37
EMISSION RATES, G/HR						
CO	1696.2	185.9	1656.7	50.0	1103.2	4.3
HC	85.0	1.6	143.0	1.6	366.6	1.4
NOX+	34.4	15.9	17.5	11.2	7.1	7.4
OIL TEMPERATURE, F	226	226	229	229	222	222
OIL PRESSURE, PSI	40	40	41	41	42	42
COOLANT TEMPERATURE, F	175	175	176	176	175	175
EXHAUST PRESSURE, IN. H2O	16.0	4.0	14.0	3.0	10.0	2.0
EXHAUST TEMPERATURE, F	914	1189	886	1163	849	1150

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	25.1	25.2	26.1	26.2	27.1	27.2
TEST DATE	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	50	50	50	50	50	50
TEMPERATURE, F	82	82	82	82	81	81
ENGINE SPEED, RPM	1500	1500	2000	2000	2000	2000
TORQUE, FT-LB	6.0	6.0	335.0	335.0	300.0	300.0
POWER, BHP*	1.7	1.7	127.3	127.3	113.9	113.9
FUEL RATE, LB/HR	12.2	11.6	70.2	70.2	69.6	69.3
IGNITION TIMING, DEG BTDC	34.0	34.0	20.5	20.5	20.5	20.5
MANIFOLD VACUUM, IN HG	17.0	17.0	.5	.5	2.0	2.0
THROTTLE ANGLE, DEG	9.0	9.0	70.0	70.0	47.0	47.0
INTAKE MAN. TEMP., F	239	239	93	93	117	117
CONCENTRATIONS, DRY BASIS						
CO, %	.9488	.0024	7.0700	7.0900	8.7700	9.3300
CO2, %	10.19	14.49	10.70	10.50	9.28	8.84
O2, %	5.83	1.05	.10	.04	.10	.03
HC, PPMC	27266	15	1970	1811	2287	2110
NOX, PPM	29	48	410	200	198	94
AIR/FUEL RATIO	15.61	15.59	11.95	11.88	11.20	10.94
EMISSION RATES, G/HR						
CO	755.2	1.8	24463.9	24434.7	28563.6	29659.9
HC	1093.8	.6	343.6	314.6	375.4	338.0
NOX+	3.3	5.2	209.3	101.7	95.1	44.1
OIL TEMPERATURE, F	219	219	249	249	255	255
OIL PRESSURE, PSI	43	43	47	47	45	45
COOLANT TEMPERATURE, F	176	176	172	172	172	172
EXHAUST PRESSURE, IN. H2O	10.0	1.0	84.0	28.0	76.0	26.0
EXHAUST TEMPERATURE, F	721	1233	1064	1079	1008	1141

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	28.1	28.2	29.1	29.2	30.1	30.2
TEST DATE	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	50	50	50	50	50	50
TEMPERATURE, F	81	81	82	82	82	82
ENGINE SPEED, RPM	2000	2000	2000	2000	2000	2000
TORQUE, FT-LB	254.0	254.0	197.0	197.0	126.0	126.0
POWER, BHP*	96.4	96.4	74.8	74.8	47.9	47.9
FUEL RATE, LB/HR	50.7	50.7	41.8	41.1	27.5	26.9
IGNITION TIMING, DEG BTDC	20.5	20.5	21.0	21.0	38.0	38.0
MANIFOLD VACUUM, IN HG	3.7	3.7	5.2	5.2	11.6	11.6
THROTTLE ANGLE, DEG	40.0	40.0	32.5	32.5	21.5	21.5
INTAKE MAN. TEMP., F	158	158	195	195	218	218
CONCENTRATIONS, DRY BASIS						
CO, %	4.3800	4.2300	2.4800	.4180	1.9400	.4740
CO2, %	12.13	12.26	13.01	14.21	13.20	14.92
O2, %	.20	.05	.77	.03	1.05	.10
HC, PPMC	1500	866	737	37	1036	15
NOX, PPM	720	365	305	75	310	93
AIR/FUEL RATIO	13.06	13.07	14.22	14.71	14.61	14.74
EMISSION RATES, G/HR						
CO	11858.2	11459.2	6010.0	1027.1	3173.6	759.8
HC	204.7	118.2	90.1	4.6	85.4	1.2
NOX+	287.6	145.9	109.0	27.2	74.8	21.9
OIL TEMPERATURE, F	253	253	249	249	245	245
OIL PRESSURE, PSI	45	45	46	46	47	47
COOLANT TEMPERATURE, F	173	173	174	174	174	174
EXHAUST PRESSURE, IN. H2O	64.0	24.0	52.0	16.0	27.0	8.0
EXHAUST TEMPERATURE, F	1084	1207	1143	1367	970	1284

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	31.1	31.2	32.1	32.2	33.1	33.2
TEST DATE	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76	5/ 6/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.0	745.0	745.0	745.0	745.0	745.0
HUMIDITY, GRAINS/LB	50	50	50	50	50	50
TEMPERATURE, F	82	82	83	83	83	83
ENGINE SPEED, RPM	2000	2000	2000	2000	2000	2000
TORQUE, FT-LB	78.0	78.0	37.0	37.0	9.0	9.0
POWER, BHP*	29.6	29.6	14.1	14.1	3.4	3.4
FUEL RATE, LB/HR	22.0	22.1	18.3	18.2	15.5	15.5
IGNITION TIMING, DEG BTDC	38.0	38.0	37.5	37.5	38.0	38.0
MANIFOLD VACUUM, IN HG	14.2	14.2	16.0	16.0	17.8	17.8
THROTTLE ANGLE, DEG	18.0	18.0	14.7	14.7	12.0	12.0
INTAKE MAN. TEMP., F	225	225	235	235	243	243
CONCENTRATIONS, DRY BASIS						
CO, %	1.3300	.2100	1.4500	.0193	.8514	.4500
CO2, %	13.67	15.21	12.75	15.06	13.14	15.06
O2, %	1.02	.12	2.00	.45	2.05	.45
HC, PPMC	1152	14	4572	21	7430	23
NOX, PPM	156	50	77	54	57	58
AIR/FUEL RATIO	14.84	14.87	15.09	15.17	15.11	14.97
EMISSION RATES, G/HR						
CO	1763.1	278.4	1638.0	21.5	914.6	420.6
HC	77.0	.9	260.3	1.2	358.3	1.1
NOX+	30.5	9.8	12.8	8.8	8.0	8.0
OIL TEMPERATURE, F	239	239	232	232	230	230
OIL PRESSURE, PSI	48	48	48	48	48	48
COOLANT TEMPERATURE, F	175	175	177	177	177	177
EXHAUST PRESSURE, IN. H2O	19.0	5.0	15.0	4.0	12.0	3.0
EXHAUST TEMPERATURE, F	948	1202	947	1230	919	1208

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	34.1	34.2	35.1	35.2	36.1	36.2
TEST DATE	5/ 6/76	5/ 6/76	5/ 6/76	5/ 7/76	5/ 7/76	5/ 7/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.0	745.0	745.0	750.0	750.0	750.0
HUMIDITY, GRAINS/LB	50	50	50	52	52	52
TEMPERATURE, F	85	85	83	83	85	85
ENGINE SPEED, RPM	2500	2500	2500	2500	2500	2500
TORQUE, FT-LB	328.0	328.0	296.0	296.0	249.0	250.0
POWER, BHP*	156.2	156.2	140.7	139.8	117.8	118.3
FUEL RATE, LB/HR	91.2	90.3	81.4	81.4	72.4	72.8
IGNITION TIMING, DEG BTDC	20.0	20.0	20.5	22.0	22.0	22.0
MANIFOLD VACUUM, IN HG	.9	.9	2.2	2.2	4.0	4.0
THROTTLE ANGLE, DEG	70.0	70.0	49.0	48.0	48.0	48.0
INTAKE MAN. TEMP., F	107	107	124	124	147	147
CONCENTRATIONS, DRY BASIS						
CO, %	6.5200	6.8700	6.6700	6.8800	6.7100	7.2000
CO2, %	9.99	9.79	9.85	9.79	10.50	10.50
O2, %	.09	.03	.05	.00	.06	.00
HC, PPMC	1941	1683	1968	1769	2038	1726
NOX, PPM	265	108	220	78	255	65
AIR/FUEL RATIO	11.96	11.80	11.86	11.77	11.98	11.83
EMISSION RATES, G/HR						
CO	29604.9	30519.0	26841.5	27492.1	24088.7	25639.9
HC	444.2	376.8	399.1	356.2	368.8	309.8
NOX+	177.5	70.8	130.6	46.2	135.7	34.3
OIL TEMPERATURE, F	254	254	267	267	258	258
OIL PRESSURE, PSI	54	54	52	52	52	52
COOLANT TEMPERATURE, F	173	173	173	173	173	173
EXHAUST PRESSURE, IN. H2O	135.0	46.0	111.0	39.0	91.0	32.0
EXHAUST TEMPERATURE, F	1123	1214	1073	1231	1088	1236

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	37.1	37.2	38.1	38.2	39.1	39.2
TEST DATE	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	750.0	750.0	750.0	750.0	750.0	750.0
HUMIDITY, GRAINS/LB	52	52	52	52	52	52
TEMPERATURE, F	86	86	87	87	83	83
ENGINE SPEED, RPM	2500	2500	2500	2500	2500	2500
TORQUE, FT-LB	204.0	204.0	127.0	127.0	75.0	75.0
POWER, BHP*	96.6	96.6	60.2	60.2	35.4	35.4
FUEL RATE, LB/HR	53.0	52.6	34.9	35.3	27.0	27.0
IGNITION TIMING, DEG BTDC	22.0	22.0	39.0	39.0	39.0	39.0
MANIFOLD VACUUM, IN HG	5.5	5.5	12.0	12.0	14.7	14.7
THROTTLE ANGLE, DEG	41.0	41.0	27.0	27.0	22.0	22.0
INTAKE MAN. TEMP., F	194	194	220	220	233	233
CONCENTRATIONS, DRY BASIS						
CO, %	2.3300	1.9300	1.3300	.2380	.8320	.0470
CO2, %	13.40	13.94	13.73	15.21	14.08	15.21
O2, %	.45	.00	.90	.25	.93	.37
HC, PPMC	705	139	686	16	749	14
NOX, PPM	520	255	540	270	255	163
AIR/FUEL RATIO	14.11	14.06	14.82	14.95	15.05	15.10
EMISSION RATES, G/HR						
CO	7084.5	5792.2	2796.5	506.6	1374.2	77.3
HC	108.0	21.0	72.7	1.7	62.4	1.2
NOX+	234.4	113.5	168.3	85.2	62.4	39.7
OIL TEMPERATURE, F	262	262	259	259	251	251
OIL PRESSURE, PSI	52	52	52	52	52	52
COOLANT TEMPERATURE, F	174	174	175	175	175	175
EXHAUST PRESSURE, IN. H2O	76.0	25.0	41.0	13.0	27.0	8.0
EXHAUST TEMPERATURE, F	1171	1370	1066	1363	1023	1258

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	40.1	40.2	41.1	41.2	42.1	42.2
TEST DATE	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	750.0	750.0	750.0	750.0	750.0	750.0
HUMIDITY, GRAINS/LB	52	52	52	52	52	52
TEMPERATURE, F	85	85	85	85	84	84
ENGINE SPEED, RPM	2500	2500	2500	2500	3000	3000
TORQUE, FT-LB	36.0	36.0	10.0	10.0	318.0	318.0
POWER, BHP*	17.0	17.0	4.7	4.7	180.4	180.4
FUEL RATE, LB/HR	22.2	22.2	18.7	18.7	105.9	106.9
IGNITION TIMING, DEG BTDC	39.0	39.0	39.0	39.0	20.0	20.0
MANIFOLD VACUUM, IN HG	16.7	16.7	18.2	18.2	1.0	1.0
THROTTLE ANGLE, DEG	18.5	18.5	16.0	16.0	70.0	70.0
INTAKE MAN. TEMP., F	250	250	250	250	109	109
CONCENTRATIONS, DRY BASIS						
CO, %	.9900	.0073	1.1000	.0024	6.9400	7.1700
CO2, %	13.80	15.06	12.13	14.84	10.70	10.40
O2, %	1.37	.50	3.20	.70	.05	.00
HC, PPMC	2302	16	12476	13	1958	1454
NOX, PPM	123	90	67	72	390	175
AIR/FUEL RATIO	15.11	15.20	15.25	15.34	11.96	11.84
EMISSION RATES, G/HR						
CO	1349.6	10.0	1294.6	2.8	36265.0	37561.5
HC	158.2	1.1	740.0	.7	515.6	383.9
NOX+	24.9	18.2	11.7	12.4	302.1	135.9
OIL TEMPERATURE, F	245	245	243	243	262	262
OIL PRESSURE, PSI	53	53	52	52	56	56
COOLANT TEMPERATURE, F	175	175	176	176	176	176
EXHAUST PRESSURE, IN. H2O	20.0	6.0	14.0	4.0	165.0	70.0
EXHAUST TEMPERATURE, F	1025	1233	1001	1330	1218	1314

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	43.1	43.2	44.1	44.2	45.1	45.2
TEST DATE	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	750.0	750.0	750.0	750.0	750.0	750.0
HUMIDITY, GRAINS/LB	52	52	52	52	52	52
TEMPERATURE, F	85	85	86	86	87	87
ENGINE SPEED, RPM	3000	3000	3000	3000	3000	3000
TORQUE, FT-LB	280.0	280.0	235.0	240.0	188.0	190.0
POWER, BHP*	159.0	159.0	133.5	136.4	106.9	108.1
FUEL RATE, LB/HR	94.8	93.9	82.8	82.7	61.6	61.7
IGNITION TIMING, DEG BTDC	20.0	20.0	20.5	20.5	25.0	25.0
MANIFOLD VACUUM, IN HG	1.7	1.7	4.1	4.1	6.5	6.5
THROTTLE ANGLE, DEG	54.0	54.0	50.0	50.0	43.0	43.0
INTAKE MAN. TEMP., F	122	122	161	161	188	188
CONCENTRATIONS, DRY BASIS						
CO, %	5.7900	5.8500	6.0700	6.3800	2.5000	2.2200
CO2, %	11.26	11.01	11.06	11.11	13.27	13.80
O2, %	.05	.00	.05	.00	.36	.00
HC, PPMC	1671	1265	1727	1338	780	284
NOX, PPM	515	240	290	170	530	410
AIR/FUEL RATIO	12.40	12.33	12.27	12.19	13.98	13.93
EMISSION RATES, G/HR						
CO	27991.7	27951.4	25412.2	26461.1	8754.7	7741.7
HC	407.0	304.5	364.4	279.7	137.6	49.9
NOX+	369.1	170.0	180.0	104.5	275.2	212.0
OIL TEMPERATURE, F	281	281	277	277	275	275
OIL PRESSURE, PSI	53	53	53	53	54	54
COOLANT TEMPERATURE, F	176	176	176	176	176	176
EXHAUST PRESSURE, IN. H2O	160.0	61.0	135.0	46.0	104.0	35.0
EXHAUST TEMPERATURE, F	1192	1367	1142	1350	1210	1427

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	46.1	46.2	47.1	47.2	48.1	48.2
TEST DATE	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76	5/ 7/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	750.0	750.0	750.0	750.0	750.0	750.0
HUMIDITY, GRAINS/LB	52	52	52	52	52	52
TEMPERATURE, F	88	88	88	88	88	88
ENGINE SPEED, RPM	3000	3000	3000	3000	3000	3000
TORQUE, FT-LB	126.0	126.0	76.0	76.0	32.0	32.0
POWER, BHP*	71.7	71.7	43.3	43.3	18.2	18.2
FUEL RATE, LB/HR	44.5	44.4	34.4	34.2	26.8	26.7
IGNITION TIMING, DEG BTDC	38.5	38.5	38.5	38.5	38.5	38.5
MANIFOLD VACUUM, IN HG	12.0	12.0	14.6	14.6	17.2	17.2
THROTTLE ANGLE, DEG	30.0	30.0	25.5	25.5	21.0	21.0
INTAKE MAN. TEMP., F	221	221	224	224	234	234
CONCENTRATIONS, DRY BASIS						
CO, %	2.0100	1.0300	1.4700	.5751	1.2100	.4400
CO2, %	13.46	14.70	13.80	14.98	14.08	15.21
O2, %	.70	.03	.73	.05	.67	.03
HC, PPMC	865	32	716	12	1271	9
NOX, PPM	420	163	245	83	128	42
AIR/FUEL RATIO	14.38	14.47	14.64	14.67	14.66	14.72
EMISSION RATES, G/HR						
CO	5233.7	2675.6	3004.8	1166.2	1928.4	698.0
HC	113.6	4.3	73.7	1.2	102.1	.7
NOX+	162.1	62.8	74.2	24.8	30.2	9.9
OIL TEMPERATURE, F	269	269	262	262	256	256
OIL PRESSURE, PSI	54	54	54	54	55	55
COOLANT TEMPERATURE, F	177	177	178	178	178	178
EXHAUST PRESSURE, IN. H2O	64.0	21.0	41.0	13.0	28.0	8.0
EXHAUST TEMPERATURE, F	1159	1440	1131	1388	1105	1325

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	49.1	49.2	50.1	50.2	51.1	51.2
TEST DATE	5/ 7/76	5/ 7/76	5/ 8/76	5/ 8/76	5/ 8/76	5/ 8/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	750.0	750.0	752.5	752.5	752.5	752.5
HUMIDITY, GRAINS/LB	52	52	45	45	45	45
TEMPERATURE, F	88	88	87	87	89	89
ENGINE SPEED, RPM	3000	3000	3500	3500	3500	3500
TORQUE, FT-LB	13.0	13.0	283.0	283.0	247.0	247.0
POWER, BHP*	7.4	7.4	186.9	186.9	163.4	163.4
FUEL RATE, LB/HR	23.8	23.8	113.2	110.6	102.9	103.1
IGNITION TIMING, DEG BTDC	38.0	38.0	22.0	22.0	22.5	22.5
MANIFOLD VACUUM, IN HG	18.5	18.5	1.6	1.6	3.0	3.0
THROTTLE ANGLE, DEG	19.5	19.5	70.0	70.0	54.0	54.0
INTAKE MAN. TEMP., F	236	236	103	103	133	133
CONCENTRATIONS, DRY BASIS						
CO, %	1.3700	.6816	5.4400	5.0300	6.3300	6.4900
CO2, %	13.80	15.06	11.55	11.55	10.90	10.90
O2, %	.95	.00	.10	.03	.08	.25
HC, PPMC	3460	70	1903	1094	1784	1180
NOX, PPM	92	38	800	475	380	260
AIR/FUEL RATIO	14.56	14.59	12.56	12.70	12.19	12.28
EMISSION RATES, G/HR						
CO	1925.4	952.6	31754.5	29035.3	32751.5	33827.7
HC	245.1	4.9	559.9	318.2	465.2	310.1
NOX+	19.2	7.9	674.5	396.1	284.0	195.8
OIL TEMPERATURE, F	254	254	281	281	291	291
OIL PRESSURE, PSI	55	55	56	56	55	55
COOLANT TEMPERATURE, F	177	177	175	175	177	177
EXHAUST PRESSURE, IN. H2O	24.0	6.0	175.0	89.0	165.0	72.0
EXHAUST TEMPERATURE, F	1094	1309	1293	1450	1209	1424

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	52.1	52.2	53.1	53.2	54.1	54.2
TEST DATE	5/ 8/76	5/ 8/76	5/13/76	5/13/76	5/13/76	5/13/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	752.5	752.5	741.3	741.3	741.3	741.3
HUMIDITY, GRAINS/LB	45	45	55	55	55	55
TEMPERATURE, F	89	89	84	84	85	85
ENGINE SPEED, RPM	3500	3500	3500	3500	3500	3500
TORQUE, FT-LB	210.0	210.0	175.0	177.0	110.0	109.5
POWER, BHP*	138.9	138.9	117.3	118.6	73.8	73.4
FUEL RATE, LB/HR	85.6	85.6	70.9	70.7	47.0	47.4
IGNITION TIMING, DEG BTDC	22.5	22.5	30.0	30.0	41.0	41.0
MANIFOLD VACUUM, IN HG	4.4	4.4	8.0	8.0	12.5	12.5
THROTTLE ANGLE, DEG	50.5	50.5	40.0	40.0	26.1	26.1
INTAKE MAN. TEMP., F	167	167	187	187	213	213
CONCENTRATIONS, DRY BASIS						
CO, %	4.4800	4.3800	2.8900	2.8200	2.1900	1.7200
CO2, %	12.13	12.26	12.75	12.88	13.01	13.67
O2, %	.05	.00	.18	.02	.50	.02
HC, PPMC	1414	936	1037	634	828	219
NOX, PPM	480	380	710	585	460	405
AIR/FUEL RATIO	12.94	12.99	13.66	13.63	14.17	14.14
EMISSION RATES, G/HR						
CO	20306.0	19913.5	11448.9	11097.7	5954.7	4693.8
HC	323.1	214.4	207.0	125.8	113.5	30.2
NOX+	314.3	249.6	423.6	346.7	188.4	166.4
OIL TEMPERATURE, F	290	290	265	265	273	273
OIL PRESSURE, PSI	55	55	56	56	56	56
COOLANT TEMPERATURE, F	177	177	173	173	174	174
EXHAUST PRESSURE, IN. H2O	156.0	57.0	109.0	37.0	62.0	20.0
EXHAUST TEMPERATURE, F	1212	1439	1307	1355	1253	1374

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	56.1	56.2	61.1	61.2	62.1	62.2
TEST DATE	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.1	737.1	737.1	737.1	737.1	737.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	83	83	88	88	87	87
ENGINE SPEED, RPM	3500	3500	3800	3800	3800	3800
TORQUE, FT-LB	30.0	30.0	155.0	155.0	104.0	105.0
POWER, BHP*	20.2	20.2	113.8	113.8	76.3	77.0
FUEL RATE, LB/HR	31.9	31.1	72.5	70.0	54.3	50.6
IGNITION TIMING, DEG BTDC	41.0	41.0	35.0	35.0	43.0	43.0
MANIFOLD VACUUM, IN HG	17.0	17.0	9.0	9.0	13.0	13.0
THROTTLE ANGLE, DEG	18.0	18.0	36.0	36.0	26.0	26.0
INTAKE MAN. TEMP., F	221	221	194	194	216	216
CONCENTRATIONS, DRY BASIS						
CO, %	1.7125	1.4450	3.3040	2.9280	2.6565	2.0830
CO2, %	13.80	14.08	12.50	12.75	13.01	13.53
O2, %	.35	.05	.30	.08	.35	.07
HC, PPMC	867	312	1152	138	738	283
NOX, PPM	200	165	800	650	580	470
AIR/FUEL RATIO	14.29	14.27	13.56	13.66	13.90	14.01
EMISSION RATES, G/HR						
CO	3169.8	2601.1	13278.5	11450.0	8173.5	6010.6
HC	80.9	28.3	233.3	27.3	114.5	41.2
NOX+	55.9	44.8	485.2	383.6	269.3	204.6
OIL TEMPERATURE, F	265	265	289	289	284	284
OIL PRESSURE, PSI	59	59	55	55	56	56
COOLANT TEMPERATURE, F	175	175	171	171	172	172
EXHAUST PRESSURE, IN. H2O	30.0	9.0	113.0	38.0	74.0	22.0
EXHAUST TEMPERATURE, F	1202	1249	1252	1385	1203	1343

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	63.1	63.2	64.1	64.2	65.1	65.2
TEST DATE	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.1	737.1	737.1	737.1	737.1	737.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	86	86	85	85	85	85
ENGINE SPEED, RPM	3800	3800	3800	3800	3800	3800
TORQUE, FT-LB	61.0	61.0	28.0	28.0	12.0	12.0
POWER, BHP*	44.7	44.7	20.5	20.5	8.8	8.8
FUEL RATE, LB/HR	42.1	43.5	32.2	32.4	29.3	28.1
IGNITION TIMING, DEG BTDC	43.0	43.0	43.0	43.0	44.0	44.0
MANIFOLD VACUUM, IN HG	16.0	16.0	17.0	17.0	17.0	17.0
THROTTLE ANGLE, DEG	21.0	21.0	17.0	17.0	15.0	15.0
INTAKE MAN. TEMP., F	221	221	215	215	228	228
CONCENTRATIONS, DRY BASIS						
CO, %	2.0330	2.0830	1.7000	1.7465	1.9375	1.7935
CO2, %	13.53	13.80	13.80	14.08	13.80	14.08
O2, %	.55	.08	.30	.06	.20	.06
HC, PPMC	889	556	809	556	960	556
NOX, PPM	335	415	180	155	155	140
AIR/FUEL RATIO	14.27	14.01	14.27	14.13	14.10	14.11
EMISSION RATES, G/HR						
CO	4962.5	5149.8	3172.0	3244.6	3249.8	2881.3
HC	109.4	69.3	76.1	52.1	81.2	45.0
NOX+	123.4	154.8	50.7	43.5	39.2	33.9
OIL TEMPERATURE, F	278	278	275	275	272	272
OIL PRESSURE, PSI	59	59	60	60	61	61
COOLANT TEMPERATURE, F	173	173	175	175	175	175
EXHAUST PRESSURE, IN. H2O	44.0	14.0	30.0	9.0	22.0	7.0
EXHAUST TEMPERATURE, F	1180	1287	1165	1244	1147	1174

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	66.1	66.2	67.1	67.2	68.1	68.2
TEST DATE	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.1	745.1	745.1	745.1	745.1	754.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	80	80	80	80	80	80
ENGINE SPEED, RPM	600	600	600	600	600	600
TORQUE, FT-LB	1.5	2.0	28.0	28.0	67.0	67.0
POWER, BHP*	.2	.2	3.2	3.2	7.6	7.5
FUEL RATE, LB/HR	4.5	4.5	5.5	5.5	6.9	6.7
IGNITION TIMING, DEG BTDC	12.0	12.0	12.0	12.0	12.0	12.0
MANIFOLD VACUUM, IN HG	17.0	17.0	15.2	15.2	13.0	13.0
THROTTLE ANGLE, DEG	.0	.0	.5	.5	1.0	1.0
INTAKE MAN. TEMP., F	157	157	156	156	155	155
CONCENTRATIONS, DRY BASIS						
CO, %	.1277	.0024	.1511	.0025	.1084	.0024
CO2, %	11.11	12.88	12.25	12.75	12.50	12.75
O2, %	5.45	3.03	3.55	3.10	3.30	3.00
HC, PPMC	16197	227	2258	193	1725	119
NOX, PPM	22	41	60	65	190	158
AIR/FUEL RATIO	17.09	17.15	17.29	17.23	17.16	17.17
EMISSION RATES, G/HR						
CO	41.2	.8	59.5	1.0	52.4	1.2
HC	263.5	3.6	44.8	3.8	42.1	2.8
NOX+	1.1	2.0	3.6	3.8	13.9	11.2
OIL TEMPERATURE, F	187	187	186	189	192	192
OIL PRESSURE, PSI	18	18	18	18	17	17
COOLANT TEMPERATURE, F	172	172	176	176	167	167
EXHAUST PRESSURE, IN. H2O	2.0	.0	4.0	.0	4.0	.0
EXHAUST TEMPERATURE, F	445	801	564	648	603	636

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	69.1	69.2	70.1	70.2	71.1	71.2
TEST DATE	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.1	745.1	745.1	745.1	745.1	745.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	81	81	81	81	81	81
ENGINE SPEED, RPM	700	700	700	700	700	700
TORQUE, FT-LB	2.0	2.0	37.0	37.0	55.0	57.0
POWER, BHP*	.3	.3	4.9	4.9	7.3	7.6
FUEL RATE, LB/HR	4.9	5.5	7.0	7.0	8.0	8.1
IGNITION TIMING, DEG BTDC	12.0	12.0	12.0	12.0	12.0	12.0
MANIFOLD VACUUM, IN HG	17.0	17.0	15.0	15.0	11.5	11.5
THROTTLE ANGLE, DEG	.0	.0	1.0	1.0	3.2	3.5
INTAKE MAN. TEMP., F	157	157	158	158	161	161
CONCENTRATIONS, DRY BASIS						
CO, %	.1650	.0049	.1373	.0049	.1721	.0024
CO2, %	10.90	12.50	12.38	12.62	11.01	12.25
O2, %	5.75	3.15	3.15	3.00	5.00	3.50
HC, PPMC	18956	147	1300	102	11162	192
NOX, PPM	28	51	96	94	45	60
AIR/FUEL RATIO	16.96	17.32	17.10	17.19	17.42	17.65
EMISSION RATES, G/HR						
CO	57.1	1.9	67.6	2.4	100.1	1.4
HC	330.8	2.9	32.3	2.5	327.0	5.7
NOX+	1.5	3.0	7.2	7.0	4.0	5.4
OIL TEMPERATURE, F	193	193	196	196	197	197
OIL PRESSURE, PSI	22	22	21	21	16	16
COOLANT TEMPERATURE, F	175	175	171	171	178	178
EXHAUST PRESSURE, IN. H2O	3.0	.0	4.0	.0	5.0	.0
EXHAUST TEMPERATURE, F	520	770	628	767	642	775

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	72.1	72.2	73.1	73.2	74.1	74.2
TEST DATE	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76	5/10/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	745.1	745.1	745.1	745.1	745.1	745.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	81	81	81	81	81	81
ENGINE SPEED, RPM	800	800	800	800	800	800
TORQUE, FT-LB	297.0	297.0	197.0	199.0	128.0	128.0
POWER, BHP*	45.1	45.1	29.9	30.2	19.5	19.5
FUEL RATE, LB/HR	25.4	25.7	16.3	16.4	13.0	13.0
IGNITION TIMING, DEG BTDC	12.0	12.0	12.0	12.0	12.0	12.0
MANIFOLD VACUUM, IN HG	1.0	1.0	4.0	4.0	5.5	5.5
THROTTLE ANGLE, DEG	28.0	28.0	18.0	18.0	13.0	13.0
INTAKE MAN. TEMP., F	176	176	173	173	202	202
CONCENTRATIONS, DRY BASIS						
CO, %	5.3700	5.4000	1.2784	.1650	.1420	.0049
CO2, %	11.33	11.44	13.14	14.63	13.14	13.35
O2, %	.15	.10	1.40	.25	2.33	2.08
HC, PPMC	2647	2304	1404	24	1081	57
NOX, PPM	790	790	280	150	153	165
AIR/FUEL RATIO	12.53	12.53	15.10	14.98	16.40	16.40
EMISSION RATES, G/HR						
CO	7024.9	7136.0	1281.4	164.4	124.1	4.3
HC	174.5	153.5	70.9	1.2	47.6	2.5
NOX+	156.5	158.1	42.5	22.6	20.2	21.8
OIL TEMPERATURE, F	208	208	214	214	208	208
OIL PRESSURE, PSI	21	21	20	20	21	21
COOLANT TEMPERATURE, F	165	165	168	168	168	168
EXHAUST PRESSURE, IN. H2O	14.0	4.0	12.0	3.0	9.0	2.0
EXHAUST TEMPERATURE, F	812	872	835	1039	828	928

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	75.1	75.2	76.1	76.2	77.1	77.2
TEST DATE	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.1	741.1	741.1	741.1	741.1	741.1
HUMIDITY, GRAINS/LB	60	60	60	60	60	60
TEMPERATURE, F	84	84	84	84	85	85
ENGINE SPEED, RPM	800	800	800	800	1500	1500
TORQUE, FT-LB	81.0	81.0	5.0	5.0	299.0	299.0
POWER, BHP*	12.4	12.4	.8	.8	86.1	86.1
FUEL RATE, LB/HR	10.4	10.4	6.3	6.3	51.8	53.8
IGNITION TIMING, DEG BTDC	21.0	21.0	12.0	12.0	17.0	17.0
MANIFOLD VACUUM, IN HG	10.0	10.0	18.2	18.2	2.0	2.0
THROTTLE ANGLE, DEG	6.5	6.5	.9	.9	39.4	40.0
INTAKE MAN. TEMP., F	171	171	180	180	151	151
CONCENTRATIONS, DRY BASIS						
CO, %	.9092	.0024	.2327	.0024	8.2600	8.0300
CO2, %	12.25	14.08	11.33	12.75	9.11	9.02
O2, %	3.10	1.43	4.50	2.40	.17	.10
HC, PPMC	8393	138	14280	159	2222	1990
NOX, PPM	56	68	40	60	285	175
AIR/FUEL RATIO	15.72	15.86	16.52	16.70	11.33	11.34
EMISSION RATES, G/HR						
CO	609.8	1.6	100.3	1.1	20295.4	20556.5
HC	283.7	4.6	310.1	3.5	275.1	256.8
NOX+	5.8	7.0	2.6	4.0	107.6	68.8
OIL TEMPERATURE, F	196	196	198	198	220	220
OIL PRESSURE, PSI	24	24	24	24	39	39
COOLANT TEMPERATURE, F	178	78	169	169	173	173
EXHAUST PRESSURE, IN. H2O	5.0	1.0	4.0	1.0	42.0	15.0
EXHAUST TEMPERATURE, F	688	972	602	855	977	1021

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	78.1	78.2	79.1	79.2	80.1	80.2
TEST DATE	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.1	741.1	741.1	741.1	741.1	741.1
HUMIDITY, GRAINS/LB	60	60	60	60	60	60
TEMPERATURE, F	85	85	85	85	86	86
ENGINE SPEED, RPM	1500	1500	1500	1500	1500	1500
TORQUE, FT-LB	206.0	207.0	136.0	136.0	84.0	84.0
POWER, BHP*	59.3	59.6	39.1	39.1	24.2	24.2
FUEL RATE, LB/HR	31.8	31.9	21.8	21.9	17.3	17.3
IGNITION TIMING, DEG BTDC	17.0	17.0	31.0	31.0	35.0	35.0
MANIFOLD VACUUM, IN HG	4.1	4.1	9.5	9.5	13.0	13.0
THROTTLE ANGLE, DEG	28.5	28.5	17.0	17.0	12.4	12.4
INTAKE MAN. TEMP., F	207	207	230	230	235	235
CONCENTRATIONS, DRY BASIS						
CO, %	2.1345	1.1240	1.6540	.2763	1.6085	.0145
CO2, %	12.38	13.53	12.50	14.08	12.02	14.08
O2, %	.95	.10	1.45	.22	2.07	.60
HC, PPMC	686	29	1130	17	2727	40
NOX, PPM	260	90	135	57	70	53
AIR/FUEL RATIO	14.47	14.44	14.98	14.90	15.27	15.29
EMISSION RATES, G/HR						
CO	4026.4	2112.2	2210.2	367.6	1750.3	15.7
HC	65.2	2.7	76.1	1.2	149.6	2.2
NOX+	75.3	26.0	27.7	11.6	11.7	8.8
OIL TEMPERATURE, F	233	233	231	231	226	226
OIL PRESSURE, PSI	37	37	38	38	40	40
COOLANT TEMPERATURE, F	171	171	174	174	175	175
EXHAUST PRESSURE, IN. H2O	31.0	10.0	18.0	5.0	13.0	3.0
EXHAUST TEMPERATURE, F	1032	1277	859	1229	840	1176

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	82.1	82.2	83.1	83.2	84.1	84.2
TEST DATE	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.1	741.1	741.1	741.1	741.1	741.1
HUMIDITY, GRAINS/LB	60	60	60	60	60	60
TEMPERATURE, F	87	87	87	87	88	88
ENGINE SPEED, RPM	2000	2000	2000	2000	2000	2000
TORQUE, FT-LB	289.0	289.0	199.0	199.0	134.0	133.0
POWER, BHP*	111.1	111.1	76.5	76.5	51.6	51.2
FUEL RATE, LB/HR	67.5	68.4	40.5	40.6	28.0	27.5
IGNITION TIMING, DEG BTDC	20.0	20.0	21.0	21.0	38.0	38.0
MANIFOLD VACUUM, IN HG	2.2	2.2	5.6	5.6	11.5	11.5
THROTTLE ANGLE, DEG	47.9	47.9	31.5	31.5	21.0	21.0
INTAKE MAN. TEMP., F	153	153	197	197	233	233
CONCENTRATIONS, DRY BASIS						
CO, %	8.3400	8.5300	1.8400	1.1100	1.9375	.3740
CO2, %	8.64	8.74	12.26	13.27	12.02	13.53
O2, %	.15	.07	.80	.10	1.30	.22
HC, PPMC	1900	1704	525	29	962	29
NOX, PPM	155	55	370	130	225	100
AIR/FUEL RATIO	11.20	11.15	14.51	14.44	14.76	14.86
EMISSION RATES, G/HR						
CO	26572.9	27339.7	4448.7	2660.7	3296.2	626.1
HC	305.1	275.3	63.9	3.5	82.5	2.4
NOX+	75.9	27.1	137.4	47.9	58.8	25.7
OIL TEMPERATURE, F	248	248	248	248	240	240
OIL PRESSURE, PSI	47	47	47	47	50	50
COOLANT TEMPERATURE, F	174	174	174	174	175	175
EXHAUST PRESSURE, IN. H2O	71.0	24.0	48.0	15.0	26.0	8.0
EXHAUST TEMPERATURE, F	991	1142	1100	1355	931	1268

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	85.1	85.2	86.1	86.2	87.1	87.2
TEST DATE	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.1	741.1	741.1	741.1	741.1	741.1
HUMIDITY, GRAINS/LB	60	60	60	60	60	60
TEMPERATURE, F	88	88	88	88	88	88
ENGINE SPEED, RPM	2000	2000	2000	2000	2500	2500
TORQUE, FT-LB	91.0	91.0	15.0	15.0	293.0	293.0
POWER, BHP*	35.0	35.0	5.8	5.8	140.9	140.9
FUEL RATE, LB/HR	22.8	23.1	14.9	15.4	81.9	82.9
IGNITION TIMING, DEG BTDC	35.0	35.0	34.0	34.0	21.0	21.0
MANIFOLD VACUUM, IN HG	13.5	13.5	18.0	18.0	2.0	2.0
THROTTLE ANGLE, DEG	16.5	16.5	10.0	10.0	50.5	50.5
INTAKE MAN. TEMP., F	236	236	244	244	165	165
CONCENTRATIONS, DRY BASIS						
CO, %	1.6312	.3598	1.3718	.0012	7.5300	7.6400
CO2, %	12.02	13.53	10.70	13.53	9.11	8.92
O2, %	1.15	.15	3.63	.55	.14	.08
HC, PPMC	1051	33	3923	40	1733	1515
NOX, PPM	125	45	41	52	190	60
AIR/FUEL RATIO	14.79	14.81	16.52	15.28	11.53	11.44
EMISSION RATES, G/HR						
CO	2271.4	504.5	1402.9	1.2	29840.0	30464.1
HC	73.8	2.3	202.2	1.9	346.1	304.4
NOX+	26.7	9.7	6.4	7.7	115.7	36.8
OIL TEMPERATURE, F	236	236	233	233	255	255
OIL PRESSURE, PSI	52	52	52	52	52	52
COOLANT TEMPERATURE, F	176	176	177	177	174	174
EXHAUST PRESSURE, IN. H2O	19.0	5.0	12.0	3.0	111.0	39.0
EXHAUST TEMPERATURE, F	927	1214	852	1237	1078	1234

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	88.1	88.2	89.1	89.2	90.1	90.2
TEST DATE	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76	5/11/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.1	741.1	741.1	741.1	741.1	741.1
HUMIDITY, GRAINS/LB	60	60	61	60	60	60
TEMPERATURE, F	90	90	89	89	89	89
ENGINE SPEED, RPM	2500	2500	2500	2500	2500	2500
TORQUE, FT-LB	210.0	210.0	134.0	134.0	77.0	77.0
POWER, BHP*	101.2	101.2	64.5	64.5	37.1	37.1
FUEL RATE, LB/HR	52.2	51.8	35.4	35.4	27.2	26.8
IGNITION TIMING, DEG BTDC	23.5	23.5	37.0	37.0	40.0	40.0
MANIFOLD VACUUM, IN HG	5.5	5.5	11.5	11.5	14.5	14.5
THROTTLE ANGLE, DEG	37.5	37.5	25.0	25.0	19.1	19.1
INTAKE MAN. TEMP., F	221	221	233	233	238	238
CONCENTRATIONS, DRY BASIS						
CO, %	2.2400	1.0200	1.8000	.6634	1.5200	1.0000
CO2, %	12.13	12.50	11.78	13.27	12.50	13.27
O2, %	.50	.10	.98	.15	.80	.10
HC, PPMC	628	262	658	11	742	14
NOX, PPM	480	430	310	115	140	50
AIR/FUEL RATIO	14.12	14.44	14.63	14.67	14.64	14.48
EMISSION RATES, G/HR						
CO	6797.4	3143.1	3854.7	1410.4	2490.3	1590.9
HC	96.0	40.6	71.1	1.2	61.2	1.1
NOX+	223.8	203.6	102.7	37.6	35.2	12.2
OIL TEMPERATURE, F	260	260	253	253	247	247
OIL PRESSURE, PSI	52	52	53	53	54	54
COOLANT TEMPERATURE, F	174	174	175	175	170	170
EXHAUST PRESSURE, IN. H2O	64.0	24.0	41.0	13.0	26.0	8.0
EXHAUST TEMPERATURE, F	1103	1383	1017	1353	1005	1275

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	91.1	91.2	92.1	92.2	93.1	93.2
TEST DATE	5/11/76	5/11/76	5/13/76	5/13/76	5/13/76	5/13/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.1	741.1	741.3	741.3	741.3	741.3
HUMIDITY, GRAINS/LB	60	60	55	55	55	55
TEMPERATURE, F	88	88	83	83	86	86
ENGINE SPEED, RPM	2500	2500	3000	3000	3000	3000
TORQUE, FT-LB	15.0	15.0	278.0	278.0	187.0	187.0
POWER, BHP*	7.2	7.2	159.5	159.5	107.6	107.6
FUEL RATE, LB/HR	18.8	18.8	94.6	94.2	59.2	58.7
IGNITION TIMING, DEG BTDC	40.0	40.0	21.0	21.0	28.0	28.0
MANIFOLD VACUUM, IN HG	18.5	18.5	2.0	2.0	7.1	7.1
THROTTLE ANGLE, DEG	12.9	12.9	51.1	51.1	36.1	36.1
INTAKE MAN. TEMP., F	255	255	133	133	203	203
CONCENTRATIONS, DRY BASIS						
CO, %	1.3500	.1811	6.8700	6.9500	2.5600	2.4200
CO2, %	12.02	13.94	10.40	10.35	13.01	13.27
O2, %	1.90	.10	.06	.01	.32	.02
HC, PPMC	6241	17	1664	1337	761	381
NOX, PPM	6	4	390	206	595	515
AIR/FUEL RATIO	14.90	14.86	11.95	11.90	13.92	13.83
EMISSION RATES, G/HR						
CO	1558.2	206.1	32156.8	32297.9	8600.0	8008.5
HC	363.0	1.0	392.7	313.2	128.8	63.5
NOX+	1.1	.7	274.9	144.2	301.0	256.7
OIL TEMPERATURE, F	239	239	255	255	268	268
OIL PRESSURE, PSI	56	56	54	54	54	54
COOLANT TEMPERATURE, F	177	177	173	173	173	173
EXHAUST PRESSURE, IN. H2O	15.0	4.0	150.0	52.0	79.0	29.0
EXHAUST TEMPERATURE, F	961	1285	1266	1288	1251	1380

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	94.1	94.2	95.1	95.2	96.1	96.2
TEST DATE	5/13/76	5/13/76	5/13/76	5/13/76	5/13/76	5/13/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	741.3	741.3	741.3	741.3	741.3	741.3
HUMIDITY, GRAINS/LB	55	55	55	55	55	55
TEMPERATURE, F	85	85	85	85	85	85
ENGINE SPEED, RPM	3000	3000	3000	3000	3000	3000
TORQUE, FT-LB	124.0	124.0	75.0	75.0	15.0	15.0
POWER, BHP*	71.3	71.3	43.1	43.1	8.6	8.6
FUEL RATE, LB/HR	43.3	45.4	34.6	33.6	22.1	23.0
IGNITION TIMING, DEG BTDC	39.5	39.5	39.0	39.0	40.0	40.0
MANIFOLD VACUUM, IN HG	12.0	12.0	14.7	14.7	18.5	18.5
THROTTLE ANGLE, DEG	25.0	25.0	19.5	19.5	12.0	12.0
INTAKE MAN. TEMP., F	218	218	220	220	234	234
CONCENTRATIONS, DRY BASIS						
CO, %	2.2200	1.5200	1.7600	1.0200	1.2100	.6100
CO2, %	12.94	13.86	13.27	14.21	13.53	14.49
O2, %	.65	.02	.63	.01	.75	.01
HC, PPMC	816	116	713	43	2587	98
NOX, PPM	360	345	205	101	81	42
AIR/FUEL RATIO	14.24	14.23	14.44	14.44	14.58	14.61
EMISSION RATES, G/HR						
CO	5585.6	3994.8	3580.2	2011.3	1590.8	829.7
HC	103.5	15.3	73.1	4.2	171.4	6.7
NOX+	136.4	136.6	62.8	30.0	16.0	8.6
OIL TEMPERATURE, F	262	262	257	257	249	249
OIL PRESSURE, PSI	55	55	56	56	57	57
COOLANT TEMPERATURE, F	174	174	175	175	176	176
EXHAUST PRESSURE, IN. H2O	55.0	27.0	36.0	11.0	20.0	6.0
EXHAUST TEMPERATURE, F	1221	1359	1193	1289	1133	1237

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	97.1	97.2	98.1	98.2	99.1	99.2
TEST DATE	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.1	737.1	737.1	737.1	737.1	737.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	86	86	86	86	86	86
ENGINE SPEED, RPM	3500	3500	3500	3500	3500	3500
TORQUE, FT-LB	254.0	254.0	170.0	170.0	113.0	113.0
POWER, BHP*	171.5	171.5	114.8	114.8	76.3	76.3
FUEL RATE, LB/HR	108.7	105.2	66.1	66.7	48.8	48.2
IGNITION TIMING, DEG BTDC	23.0	23.0	31.0	31.0	42.0	42.0
MANIFOLD VACUUM, IN HG	2.5	2.5	8.2	8.2	12.0	12.0
THROTTLE ANGLE, DEG	58.5	58.5	37.8	37.8	26.0	26.0
INTAKE MAN. TEMP., F	152	152	207	207	213	213
CONCENTRATIONS, DRY BASIS						
CO, %	6.0200	6.0400	3.0700	2.9600	2.3000	1.9400
CO2, %	10.95	11.11	13.01	13.14	13.27	13.80
O2, %	.05	.01	.25	.02	.47	.02
HC, PPMC	1696.	1267	1098	694	762	318
NOX, PPM	475	415	670	630	480	460
AIR/FUEL RATIO	12.28	12.30	13.66	13.60	14.12	14.05
EMISSION RATES, G/HR						
CO	33155.0	32183.6	11290.5	10924.2	6451.5	5334.1
HC	470.8	340.2	203.5	129.1	107.7	44.1
NOX+	394.8	333.7	371.8	350.8	203.2	190.9
OIL TEMPERATURE, F	281	281	280	280	273	273
OIL PRESSURE, PSI	54	54	55	55	57	57
COOLANT TEMPERATURE, F	171	171	171	171	173	173
EXHAUST PRESSURE, IN. H2O	150.0	67.0	104.0	34.0	66.0	20.0
EXHAUST TEMPERATURE, F	1312	1394	1253	1386	1237	1363

* CORRECTED SAE J816B
+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	100.1	100.2	101.1	101.2	102.1	102.2
TEST DATE	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76	5/14/76
FUEL CODE	7602	7602	7602	7602	7602	7602
BAROMETER, MMHG	737.1	737.1	737.1	737.1	737.1	737.1
HUMIDITY, GRAINS/LB	56	56	56	56	56	56
TEMPERATURE, F	85	85	85	85	87	87
ENGINE SPEED, RPM	3500	3500	3500	3500	3800	3800
TORQUE, FT-LB	71.0	71.0	15.0	15.0	236.0	236.0
POWER, BHP*	47.9	47.9	10.1	10.1	173.2	173.2
FUEL RATE, LB/HR	37.7	38.4	26.8	26.5	116.2	116.7
IGNITION TIMING, DEG BTDC	42.0	42.0	42.0	42.0	26.0	26.0
MANIFOLD VACUUM, IN HG	15.0	15.0	18.5	18.5	2.5	2.5
THROTTLE ANGLE, DEG	20.5	20.5	13.5	13.5	58.0	58.0
INTAKE MAN. TEMP., F	221	221	237	237	165	165
CONCENTRATIONS, DRY BASIS						
CO, %	1.8400	1.5200	1.7998	1.8600	6.6700	6.6600
CO2, %	13.67	14.10	13.86	13.94	10.60	10.60
O2, %	.47	.01	.20	.01	.05	.01
HC, PPMC	809	220	1099	753	1781	1408
NOX, PPM	260	240	110	98	355	275
AIR/FUEL RATIO	14.31	14.22	14.14	14.03	12.02	12.03
EMISSION RATES, G/HR						
CO	4031.8	3364.4	2766.8	2801.7	38518.7	38637.9
HC	89.3	24.5	85.1	57.1	518.4	411.6
NOX+	86.0	80.2	25.5	22.2	309.4	240.7
OIL TEMPERATURE, F	268	268	258	258	292	292
OIL PRESSURE, PSI	57	57	58	58	55	55
COOLANT TEMPERATURE, F	174	174	175	175	170	170
EXHAUST PRESSURE, IN. H2O	41.0	13.0	21.0	6.0	150.0	73.0
EXHAUST TEMPERATURE, F	1202	1314	1129	1183	1272	1401

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

ENGINE CODE BUI455

TEST NUMBER	106.1	106.2	107.1	107.2
TEST DATE	5/15/76	5/15/76	5/15/76	5/15/76
FUEL CODE	7602	7602	7602	7602
BAROMETER, MMHG	744.2	744.2	744.2	744.2
HUMIDITY, GRAINS/LB	57	57	57	57
TEMPERATURE, F	83	83	86	86
ENGINE SPEED, RPM	3800	3800	4000	4000
TORQUE, FT-LB	7.0	7.0	240.0	240.0
POWER, BHP*	5.1	5.1	183.5	183.5
FUEL RATE, LB/HR	28.8	29.0	179.9	178.4
IGNITION TIMING, DEG BTDC	43.0	43.0	26.0	26.0
MANIFOLD VACUUM, IN HG	18.5	18.5	1.5	1.5
THROTTLE ANGLE, DEG	14.0	14.0	66.5	66.5
INTAKE MAN. TEMP., F	224	224	143	143
CONCENTRATIONS, DRY BASIS				
CO, %	1.8600	1.8600	4.6800	4.9500
CO2, %	13.67	13.80	12.02	11.78
O2, %	.18	.03	.15	.05
HC, PPMC	982	636	1905	1442
NOX, PPM	125	125	875	600
AIR/FUEL RATIO	14.10	14.05	12.89	12.75
EMISSION RATES, G/HR				
CO	3067.9	3078.9	44426.2	46153.5
HC	81.6	53.1	911.4	677.5
NOX+	31.2	31.3	1258.3	847.5
OIL TEMPERATURE, F	272	272	294	294
OIL PRESSURE, PSI	61	61	57	57
COOLANT TEMPERATURE, F	175	175	169	169
EXHAUST PRESSURE, IN. H2O	24.0	7.0	150.0	98.0
EXHAUST TEMPERATURE, F	1169	1162	1368	1456

* CORRECTED SAE J816B

+ CORRECTED FOR HUMIDITY

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